

ENGINEERS AUSTRALIA

## CEREMONY REPORT

# ***B-24 Liberator Heavy Bomber & Hangars of Werribee Satellite Aerodrome Heritage Recognition Ceremony***

Corner of Farm Road and Geelong Road, Werribee, Victoria



**Date of ceremony: 13 July 2014**

**Cover Photograph:**

**B-24 Liberator A72-176, the last remaining RAAF Liberator, approaching fully restored condition within its heritage timber-trusses hangar at Werribee Satellite Aerodrome.**

**This image was taken on the day of the Heritage Recognition Ceremony immediately after the unveiling was completed.**

*Image: Owen Peake*

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## 1 Introduction:

The ceremony was a double heritage recognition ceremony for:

- B-24 Liberator Long Range Heavy Bomber A72-176, the last surviving Liberator of the 288 which saw RAAF service.

Awarded an **ENGINEERING HERITAGE INTERNATIONAL MARKER**.

- The timber-trussed hangars which were built at Werribee Satellite Aerodrome during WWII. The aerodrome was used as a flight crew training base for Point Cook and Laverton Air Bases which are nearby.

Awarded an **ENGINEERING HERITAGE MARKER**.

Ceremony conducted at on 13 July 2014 at the B-24 Liberator Memorial Restoration Inc base (previously the Werribee Satellite Aerodrome), corner of Farm Road and Geelong Road, Werribee at 2:00 pm.

Attendance: 120 to 130

## 2 Invitations:

There were two forms of invitation:

2.1 Written invitation (see Attachment 1) sent by mail to 148 people listed by Engineering Heritage Victoria. This list consisted primarily of local dignitaries, council representatives, politicians, heritage industry figures and other stakeholders.

2.2 Email invitations (see copy of flyer at Attachment 2) sent to the following address lists:

- Engineering Heritage Victoria list (approx 400 on list)
- Victoria Division Board of Engineering members (approx 40 on list)
- Geelong Regional Group (number not known - say 200)
- Engineering Heritage Australia Member and Corresponding Members (45 on list)
- Email to all members (say 200 people) of B-24 Liberator Memorial Restoration Australia Inc. The number of emails is not known but 95 of the attendees were from the B-24 group.

Hence the total number of invitations issues was at least 833. With at total attendance of say 130 at the ceremony the response rate is approximately 12.6%.

### **3. Distinguished Guests and Apologies:**

Listed on the Running Sheet. See Attachment 3.

### **4 Program & Running Sheet:**

The Running Sheet (Attachment 3) shows:

- Those who spoke at the event and timing
- Distinguished Guests who were acknowledged
- Apologies received who were acknowledged

The Master of Ceremonies was Mr Owen Peake, Chair, Engineering Heritage Victoria.

### **5 Speech Notes:**

Speech Notes are attached as follows:

- Alex Baitch, National President of Engineers Australia (see Attachment 4)

### **6 Ceremony Handout:**

An A5 ceremony handout was prepared and handed out to all those who attended the ceremony. A copy is at Attachment 5. The handout was based largely on the material from the Interpretation Panels. 100 copies were printed.

### **7 Media Release:**

Engineers Australia National Office issued a Media Release. A copy is at Attachment 6.

### **8 Media Articles:**

#### **8.1 ARTICLE FOR ENGINEERING HERITAGE AUSTRALIA NEWSLETTER**

Article written by Owen Peake is at Attachment 7.

#### **8.2 ARTICLE FOR ENGINEERS AUSTRALIA MAGAZINE**

Article written by Owen Peake is at Attachment 8.

#### **8.3 ARTICLE IN WHYNDAM LEADER**

Article written by Sarah Anderson is at Attachment 9.

## 9 Letters of Thanks:

Letters on EA Victoria Division letterhead were sent out over Geoff Hayes's signature to key participants:

A typical draft letter for the above is at Attachment 10.

## 10 Costing

Costs of the project were incurred as per the following table:

Item No.	Description	Funding Source	Amount
1	Interpretation Panel Manufacture - Advanced Group (2 panels)	EHV Budget	\$906.40
2	Graphic Design of Interpretation Panel - Richard Venus	EHA Budget (through National Office)	\$800.00
3	Manufacture of Mounting Frame for Interpretation Panels – B-24 Group (2 frames)	B-24 Group	nil
4	Painting of Mounting Frames for Interpretation Panels – B-24 Group (2 frames)	EHV Budget	\$143.00
5	Car travel costs to Owen Peake. Not claimed as Werribee is in Melbourne.	EHV Budget	nil
6	Trailer hire costs to move frames to Melbourne for painting then return them.	EHV Budget	\$149.00
7	Provision of PA system – B-24 Group	B-24 Group	nil
8	Printing of Handout documents (100 off)	EHV Budget	\$500.00 (estimate)
9	Provision of afternoon tea	B-24 Group	nil
10	Installation of Interpretation Panel Mounting Frames.	Owen Peake	nil
11	Provision of 300mm diameter EHA marker from EA National Office (2 markers)	EHA Budget (through National Office)	\$600 (estimate)
12	Proof reading of two nomination documents by Tropical Dragon	EHV Budget	\$120.00
		<b>TOTAL</b>	<b>\$3218.40</b>

## 11 Allocation of Tasks

A schedule showing the Allocation of Tasks between the various stakeholders was used. This document ensured that all details of organisation were attended to and served as a check list in the run-up to the event.

The tasks of planning of the ceremony were primarily shared between Jessica Bradley in the Victoria Division EA office, Owen Peake, EHV volunteer and Judy Gilbert of B-24 Liberator Memorial Restoration Australia Inc.

## 12 Interpretation Panel:

The two interpretation panel are 1200 mm wide and 600 mm high and digitally printed on vinyl film on an aluminium substrate. The Engineering Heritage Markers are mounted on the cross bar below the interpretation panels. This marker is the standard 300 mm diameter vitreous enamel on steel marker used by EHA.

The panels are mounted as follows:

- B-24 Liberator – on a movable stand to go alongside the aircraft. In other respects the stand is similar to the EHA standard.
- Werribee Hangars – on a fixed stand mounted in the ground at the north western corner of the hangar containing the B-24. The stand is to the EHA standard.



**B-24 Liberator RESTORATION**

**Restoring a Legendary Long Range Heavy Bomber**

**A72-176**

The B-24 Liberator is an American heavy bomber designed and built by the Consolidated Aircraft Corporation of San Diego, California. The prototype flew on 29 December 1939 and the aircraft went into production the following year.

**Operational History**

The B-24 became the standard American heavy bomber in the Pacific because of its long range. They were also used by other Allied air forces: 2100 by the British (where they were known as the Liberator), 1200 by the Canadians, and 287 by the Royal Australian Air Force.

By the end of the Second World War in August 1945, seven RAAF squadrons were carrying out long range bombing operations with B-24s from bases in Western Australia, the Northern Territory, the Netherlands East Indies, and the Philippines.

Most Australian B-24 crews were trained at the RAAF No 7 Operational Training Unit at Tocumwal, NSW. This was a very significant unit covering an enormous area with 50 aircraft and 5000 personnel at its peak in 1945.

**Unique Engineering Features**

The B-24 was a notable advance in aviation engineering, being the first practical application of the Davis wing. This gave greater performance from a lighter structure. The wing is actually one piece with the body (fuselage) attached to it. The B-24 also pioneered the tricycle undercarriage which has now become common on large four-engined aircraft.

**Davis High-lift Aerofoil**

Freelance Aeronautical Engineer David Davis (1894-1972) designed a thick wing profile with low drag and high lift which was adopted in the B-24 – the design was abandoned in later years because it was unsuitable for higher speed aircraft.

**Restoration at Werribee**

A72-176 is the last Australian Liberator. It is also the world's only surviving B-24MR model (R denoting Radar). All the other Australian planes had been sold for scrap. In 1988 the B-24 Memorial Fund was formed and acquired the fuselage in 1995. The wing and tailplane of an American B-24D had been recovered in New Guinea and brought to Australia in 1992. These components are now being combined into a faithful restoration of the Liberator by volunteers at Werribee.

**Fowler Flaps**

Designed by Harlan Fowler in 1924, this flap slides back as well as rotating – combined with the Davis wing, it provided high lift for take-off and low stall speed for safe landing.

**Recovering the fuselage from Moos, Victoria**

Engineering Heritage Marker placed on 12 July 2014

Engineers Australia Victoria Division - B-24 Liberator Memorial Restoration Australia Inc

For more details about this and other engineering heritage works, go to [www.engineersaustralia.org.au/heritagemarkers](http://www.engineersaustralia.org.au/heritagemarkers)

B-24 Liberator Panel

# Werribee Satellite Aerodrome Hangars

## Including the largest clear span timber trussed building in Victoria

**The Pacific War, 1942**

The United States of America entered the Second World War following the bombing of Pearl Harbour (Hawaii) by the Japanese in 1941. Australia then became a base for Allied forces in the Pacific War.

This led to a need to build new facilities for both Australian and particularly US forces in Australia. These hangars, and others like them elsewhere in Australia, were part of that effort.

**Satellite Aerodromes**

Werribee was a satellite aerodrome to Point Cook and Laverton air bases. It was only intended to train air crews and had no formed runways, just grassed landing strips.


There were five hangars, a workshop, and accommodation and administration buildings.

Today, only two hangars and the workshop remain. Hangar 1 and the workshop are no longer safe to enter. Hangar 2 now has additional roof supports and houses the restoration of the B-24 MR Liberator.


**Design Adaptation**

To accommodate aircraft – such as the B-24 – with large wingspans, hangars had to provide a very wide unobstructed space. A roof design known as a Pratt truss is able to span large distances. It consists of a series of triangular units connected at joints.


American engineers had designed aircraft hangars with steel trusses. However, during the War, the design had to be adapted to use Australian hardwood with TECO connectors, originally developed for American softwoods. Four hangars (including Hangar 2) at Werribee spanned 96 feet or nearly 30 metres while Hangar 1 spans 130 feet or 40 metres.




**TECO Split Ring and Shear Plate Connectors**



Truss joints are critical points. They must be strong enough to carry the load of the truss itself and the roof it supports. The TECO connectors spread the load, strengthen the joints, and reduce the number of bolts needed. These American fittings plus local hardwood were the key to building the large clear span hangars needed by the Allies.



**Hangar 2 under construction in 1942**




Private Highway  
New Farm Road  
Roads show extent of aerodrome



**B-24 LIBERATOR**  
AUSTRALIA

ENGINEERS AUSTRALIA

Engineering Heritage Marker 13 July 2014  
Engineers Australia - B-24 Liberator Memorial Restoration Australia Inc

For more details about this and other engineering heritage works, go to [www.engineersaustralia.org.au/heritageregister/research](http://www.engineersaustralia.org.au/heritageregister/research)



*Edward Theodore*      *George Kenny*

**Edward Theodore (1884-1959)**  
Hard-driving Director-General of the Allied Works Council, Theodore recommended the formation of the Civilian Construction Corps (CCC) to increase the construction capacity for military facilities without over-loading the military construction units. The CCC eventually employed over 77000 workers. He helped Australia and the US win the War by providing essential facilities behind the scenes.

**General George Kenny (1899-1977)**  
Kenny commanded the US Fifth Air Force, based in Brisbane. This force, flying alongside the RAAF, operated in the South West Pacific area. Their particular targets were enemy shipping and the increasingly isolated enemy bases throughout the islands. The mighty Liberator was one of the 'tools of trade' of these air forces.

## Werribee Satellite Aerodrome Hangars

## 13 Photographs:



**Alex Baitch addressing the Heritage Recognition Ceremony.**

*Image: Owen Peake*



**Doug Lindsay with the Hangar panel after unveiling.**

*Image: Owen Peake*



The unveiling of the Hangar panel by from left: Alex Baitch; Andrew Elsbury MLC and Doug Lindsay, President of B-24 Liberator Memorial Preservation Australia Inc.  
*Image: Owen Peake*



Crowd inside the hangar during the ceremony.  
*Image: Owen Peake*



**Andrew Elsbury MLC speaking at the ceremony.**

*Image: Owen Peake*



**The Liberator panel after unveiling on its moveable frame.**

*Image: Owen Peake*

**Attachment 1 - Invitation Letter****ENGINEERS AUSTRALIA  
VICTORIA DIVISION**

Dear.....

**B-24 Liberator heavy bomber and the Werribee aircraft hangars**

In the dark days after the bombing of Pearl Harbour on 7 December 1941 and the declaration of war by the United States of America against the Japanese Empire a powerful alliance was formed between the US and Australia.

The United States moved its huge industrial economy into top gear in order to protect itself. Australia provided the bases and other facilities to form a jumping-off point for military action to defend the South West Pacific Region. Australia and the United States fought together until the end of the War and remain close allies to this day.

The hangars at Werribee were built to provide air crew training facilities for Australian and American flyers.

A large fleet of B-24 Liberator heavy bombers was acquired by the RAAF from US manufacturers and became a key part of the struggle to regain control of "The Islands".

**Join Engineering Heritage Victoria and B-24 Liberator Memorial Restoration Australia Inc in recognising the significance of the LIBERATOR and the HANGARS at Werribee Satellite Aerodrome with Engineering Heritage Markers on Sunday 13 July 2014 at 2:00 pm at the B-24 Liberator site at the corner of the Princes Highway and Farm Road, Werribee.**

All are welcome to attend.

Yours sincerely

Glenda Graham

## Attachment 2 - Advertising Flyer

**EA VICTORIA**  
ENGINEERING HERITAGE



### B-24 Liberator & Werribee Hangars Heritage Marking Ceremony

Dear Jessica,

The B-24 Liberator was an American designed and built heavy bomber aircraft used by many Allied air forces during World War II. More Liberators were built than any other Allied military aircraft during World War II. It could carry a heavier weapons load further and fly faster than comparable heavy bombers.

The Liberator proved to be very effective in the hands of skilled and dedicated crews. The Royal Australian Air Force (RAAF) operated 287 Liberators in the latter years of the Pacific War, from bases in Northern Australia and the Islands.

B-24 Liberator Memorial Restoration Australia has been restoring the very last surviving RAAF Liberator registration number A72-176 for two decades. The work is now well progressed and visitors can appreciate the size and complexity of the big bomber.

The ceremony will also recognise the hangars of the Werribee Satellite Aerodrome. There were once 5 similar hangars using very long span timber roof trusses of up to 40 metres.

Join Engineering Heritage Victoria in recognising the significance of the B-24 Liberator & Werribee Hangars with Engineering Heritage Markers on Sunday 13 July. [>>Click here to register.](#)



**Date:**

**13 July 2014**

**Time:**

**1.45pm for 2pm -  
2:40pm**

**Venue:**

**B-24 Liberator  
Memorial Restoration  
Australia Hangar  
Cnr Farm Rd &  
Geelong Rd  
Werribee, VIC**

**All are welcome to  
attend.**

> [Contact us](#)

REGISTER NOW

[www.engineersaustralia.org.au/victoria](http://www.engineersaustralia.org.au/victoria)

## Attachment 3 - Running Sheet

### CONTACT LIST

#### Engineers Australia Key Staff

Glenda Graham	Executive Director	0434 070 688
Jessica Bradley	Marketing & Events Coordinator	0433 651 475

#### Engineers Australia Key Stakeholders

Alex Baitch	National President	0412 344 821
John McIntosh	National Councillor	0418 128 121
Carla Cher	National Councillor	?

#### Other Event Key Stakeholders

Andrew Elsbury	Member of the Legislative Council for Western Melbourne	(03) 8742 3226
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#### EHV Member

Owen Peake	Chair, EHV	0402 933 328
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#### Event Sponsor Representatives

Judy Gilbert	Secretary, B-24 Liberator Memorial Restoration Australia	(03) 9734 0094
Doug Lindsay	President, B-24 Liberator Memorial Restoration Australia	0418 745 440

### KEY EVENT INFORMATION

**Topic:** LIBERATOR & WERRIBEE HANGARS Engineering Heritage Recognition Ceremony

[Note: This is a double ceremony recognizing two elements on the same site]

**Date:** Sunday 13 July 2014

**Time:** 2:00 pm to 2:40 pm

**Venue:** B-24 Liberator Memorial Restoration Australia Inc, Princes Highway and Farm Road, Werribee.

[The venue will be inside the hangar containing the B-24 Liberator]

**RUN SHEET**

<b>Time</b>	<b>Action</b>	<b>Responsible</b>
1:00pm–1:45pm	Set Up Site – banners, chairs (reservations), speakers, lectern, booklets, PA system	Jess/Owen/B-24 volunteers
1:45pm– 2:00pm	Guests arrive Greet Guests/Handout booklets	Jess/Owen/B-24 volunteers
2:00pm– 2:05pm	Speeches to commence  Welcome by Master of Ceremonies (MC) Owen Peake, Chair Engineering Heritage Victoria: <ul style="list-style-type: none"> <li>• Welcome to B-24 Liberator site.</li> <li>• Housekeeping: turn off mobile phones, location of toilets in back of the hangar.</li> <li>• Point out that this ceremony is unusual in that two elements (the Liberator and the hangars) are being recognised: <ul style="list-style-type: none"> <li>▪ B-24 Liberator – Engineering Heritage International Marker</li> <li>▪ Werribee Hangars – Engineering Heritage Marker</li> </ul> </li> <li>• Although is a free event you are reminded that B-24 Liberator Memorial Restoration Australia needs all the donations you can afford for its good work.</li> <li>• Acknowledgment of Distinguished Guests and Apologies (see next page for details).</li> </ul>	Owen Peake
2:05pm–2:11pm	Professor Alex Baitch, National President, Engineers Australia	Alex Baitch
2:12pm–2:18pm	Doug Lindsay, President, B-24 Liberator Memorial Restoration Australia Inc	Doug Lindsay
2:19pm–2:25pm	Andrew Elsbury, Member of the Legislative Council for Western Metropolitan	Andrew Elsbury
2:26pm–2:30pm	MC invites Alex Baitch, Doug Lindsay and Andrew Elsbury to unveil the interpretation panel of the LIBERATOR and pose for photos. Photos to be taken of marker unveiling.	Official Party Jess/Owen
2:30pm–2:34pm	Closing remarks by MC <ul style="list-style-type: none"> <li>• Thanks to: B-24 volunteers; Staff of Engineers Australia Victoria Division and all the speakers at the ceremony.</li> <li>• Invite those attending to afternoon tea.</li> <li>• Invite everyone to sign the Visitors Book.</li> <li>• Invite those present to move outside to see the unveiling of the HANGAR interpretation panel.</li> </ul>	Owen Peake
2:34pm–2:40pm	Official party moves out to the HANGARS interpretation panel outside the hangar and unveil it. Photos to be taken of marker unveiling.	Official Party Jess/Owen
2:40pm–3:00pm	Pack up	Jess/Owen

**DISTINGUISHED GUESTS TO BE ACKNOWLEDGED**

- The Liberator Community (see separate document)
- Professor Alex Baitch, National President, Engineers Australia
- Doug Lindsay, President, B-24 Liberator Memorial Restoration Australia Inc
- Andrew Elsbury, Member of the Legislative Council for Western Metropolitan
- Bob Fairclough, Mayor of City of Wyndham
- Councillors of the City of Wyndham
- Carla Cher, National Councillor of Engineers Australia
- Keith Baker, Chair of Engineering Heritage Australia
- Patricia Heard from the Wyndham Tourist Association
- Paul Balassone from Melbourne Water
- The four Engineering students from Victoria University who wrote the nominations for the Liberator and the Hangars:
  - Thanh Ho
  - Chris Killick
  - Elias Tagas
  - Alan Hankins

**APOLOGIES TO BE ACKNOWLEDGED**

- John McIntosh National Councillor of Engineers Australia
- John Berry, Ambassador to Australia for the United States
- John Eren Member of the Legislative Assembly for Lara

## Attachment 4 Speech Notes – Alex Baitch

Ladies and Gentlemen:

### Heritage Recognition Program

- Engineering Heritage is one of the foundation building blocks of the **learned body function** of **Engineers Australia**.
- Engineers require a knowledge of the history of their profession and the achievements of the engineers that went before them in order to understand how the profession developed over time and to learn from the mistakes made in the past.
- **Only by understanding the past can we hope to find better ways of doing things in the future.**
- The **Heritage Recognition Program** aims to join with local communities to **recognise** and **celebrate** the great engineering achievements of the past in their communities.
- The past can be two centuries ago or just last year.
- Ceremonies such as this one form the central plank of the **Heritage Recognition Program**.
- The program has been in place since 1984 and every year ten to fifteen sites around Australia are recognised at ceremonies such as this one.
- The sites and works recognised represent all aspects of engineering with the works coming from **many differing eras** in our national history and from **every discipline** of engineering.

- This event celebrates two iconic works of engineering heritage:
  - The B-24 Liberator aircraft
  - The hangars which were built on this site (and other sites) to support the War Effort during the Second World War.
- These two recognitions are the **180<sup>th</sup> and 181<sup>st</sup> works** recognised under the **Heritage Recognition Program**.

### What has already been recognised?

- A significant number of Colonial Era infrastructure projects have been recognised throughout Australia. These range from the **Overland Telegraph Line** between Darwin and Adelaide which connected Australia to the outside world with wires to very old bridges such as the **Richmond Bridge** in Tasmania built by convict labour to the great railway constructions from about the middle of the 19<sup>th</sup> century until the early years of the 20<sup>th</sup> century.
- Great nation-building works were built during the early 20<sup>th</sup> century such as the **Sydney Harbour Bridge**, the **Coolgardie Water Supply Pipeline** in Western Australia and the **Trans-Continental Railway**.
- In the middle of the 20<sup>th</sup> century Australia was involved in the Second World War both in Europe and in the Pacific.
- It was the Pacific War which threw Australia back onto its own resources to a great degree. The British Empire was exhausted by the War in Europe and when Japan bombed Pearl Harbour we suddenly found ourselves having to defend our own shores against imminent invasion. We quickly formed a new alliance with the **United States of**

**America** and soon discovered that we worked well with the Americans – both nations had a powerful “can do” mentality. A vigorous relationship of mutual trust developed and with it great engineering achievements were made in a very short time.

- **That part of our history brings us to today and to this ceremony.**
- The **Liberators** were not built in Australia but in the United States. They were, at the time, the latest thing in large aircraft technology. America had geared up its industrial might to build the weapons of war needed to win the Pacific War. Australians in the RAAF embraced the technology and quickly learned the tricks of the trade to make the mighty **Liberator** a powerful and deadly weapon.
- Meanwhile Australia had taken on the task of building a wide range of facilities in Australia (and later in the Islands) to provide the jumping off points for Allied military action to the north. This hangar is one of the remaining examples of this work. It was done in a great hurry and it was done with **innovative engineering** to do things quicker, smarter and with the limited available materials.
- You will hear more about the **B-24 Liberator** and the **hangar** as this ceremony progresses.
- After the Second World War was over Australia moved almost immediately into a growth burst that went on for decades. We built huge amounts of infrastructure and new industries. There were many large engineering projects such as the **Snowy Mountain Scheme**, the **Gladesville Bridge** and the extensive high density road networks which serve our larger cities.
- But we also took to invention in a big way, led by the CSIRO.
- Post-war our scientists and engineers led the world in many technologies. We became leaders in astronomy, we built the Microwave

Landing System **INTERSCAN**, invented the Flight Data Recorder “**Black Box**” and later the **Cochlear Implant** and **Wi-Fi**.

- These great engineering achievements have either been recognised under the **Heritage Recognition Program** or are in the planning phase.
- Over more than 200 years we have **engineered Australia** and that process continues every day. That is what the **Heritage Recognition Program** remembers.

Thank you.

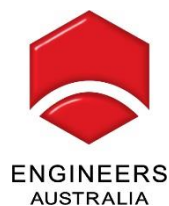
## Attachment 5 – Handout Document

ENGINEERS AUSTRALIA  
ENGINEERING HERITAGE VICTORIA  
B-24 LIBERATOR MEMORIAL RESTORATION AUSTRALIA



# *The Story of the B-24 Liberator and the Werribee Aircraft Hangars*

**Heritage Recognition Ceremony  
Sunday 13 July 2014**





**Engineering Heritage Victoria and B-24 Liberator Memorial Restoration Australia Inc are recognising the significance of the LIBERATOR and the HANGARS at Werribee Satellite Aerodrome with Engineering Heritage Markers on Sunday 13 July 2014 at 2:00 pm at the B-24 Liberator site at the corner of the Princes Highway and Farm Road, Werribee.**

# *The Story of the B-24 Liberator*

In the dark days after the bombing of Pearl Harbour on 7 December 1941 and the declaration of war by the United States of America against the Japanese Empire a powerful alliance was formed between the US and Australia.

The United States moved its huge industrial economy into top gear in order to protect itself. Australia provided the bases and other facilities to form a jumping-off point for military action to defend the Southwest Pacific Region. Australia and the United States fought together until the end of the War and remain close allies to this day.

The hangars at Werribee were built to provide air crew training facilities for Australian and American flyers.

A large fleet of B-24 Liberator heavy bombers was acquired by the RAAF from US manufacturers and became a key part of the struggle to regain control of "The Islands".

oooooooooooooooooooo

69 years after the end of the Second World War we have the privilege of meeting here to celebrate the people who built, flew and maintained the Liberators. We are able to meet in one of the hangars built to support the joint US and Australian war effort as part of Werribee Satellite Aerodrome which was built to train United States and Australian air crews.

The Liberator in the hangar is the very last of the RAAF Liberators, restored by B-24 Liberator Memorial Restoration Australia during the last two decades.

This last Australian Liberator is, however just part of a much larger story. Over 18800 Liberators were built in the United States and they served in almost every theatre of World War II and were supplied to the air forces of many Allied Nations including the United States, Great Britain and Australia.

The aircraft incorporated a number of engineering breakthroughs which gave it a higher level of performance than other heavy bombers of its era. It incorporated the Davis Wing which gave it greater range, speed and payload capacity; it incorporated Fowler Flaps for better performance during take-off and landing; it was the first large aircraft to use a retractable tricycle undercarriage; it was one of the earliest aircraft types to be equipped with airborne radar and it was powered by four huge radial piston engines – the legendary Pratt & Whitney Twin Wasp – renowned for their reliability.



**Liberator: In service and A72-176 under restoration at Werribee.**

**Source (both images): B-24 Liberator Memorial Restoration Australia Inc.**

## *Key people associated with the Liberator*

### **Reuben Hollis Fleet (1887 - 1975)**

Reuben Hollis Fleet was born on March 6<sup>th</sup>, 1887, in Montesano, Washington, United States. He attended Culver Military Academy in 1906 and went on to form a real estate business and became the youngest member of the state legislature in 1915. Just days before the United States entered the First World War, Fleet volunteered for pilot training with the US Army Signal Corps Aviation Section on March 22<sup>nd</sup> in 1917, thus beginning his long career in aviation. In 1919 Fleet was reassigned to McCook Field in Dayton, Ohio, at the US Army Flight Test Centre, where he made contact with US aircraft contractors and manufacturers.

Fleet formed Consolidated Aircraft Corporation on May 29 1923 and moved the company to San Diego, California in 1935. The company's first focus was on seaplanes. Consolidated developed a long line of successful designs and lucrative contracts for seaplanes for the Navy. Starting with their XPY-1 of 1928, the company's string of successes culminated in one of the most numerous and successful seaplanes, the Consolidated PBY Catalina. The RAAF also operated Catalinas as its primary Maritime Patrol aircraft during World War II.

Consolidated went on to become a key supplier of heavy bombers with the widely produced B-24 Liberator playing a key role in the Allied strategic bombing campaigns, and the Convair B-36, the world's largest piston engine bomber, filling a crucial gap in the Cold War years until jet-powered bombers became widely available.

Fleet left Consolidated after the War and followed many interests in his subsequent busy life. Fleet died in San Diego, California on October 29, 1975 at age 88 from injuries related to a fall.



**Reuben Hollis Fleet  
(1887 - 1975)**

***Source: "These We Honour", The International Hall of Fame, The San Diego Aerospace Museum, San Diego CA, 1984.***

**David R. Davis (1894 – 1972)**

David Davis was the co-founder of Davis-Douglas Company. He was a freelance aeronautical engineer and developed the high lift wing platform known as the Davis Wing used on the Consolidated B-24 Liberator.



**David R Davis**

**At right in this image**

**Source: San Diego Air and Space Museum Archive**

# *The Story of the Werribee Hangars*

There was a need to build new facilities to accommodate both Australian and particularly US forces in Australia. The Werribee hangars, and others like them elsewhere in the country, were a small part of that effort.

Werribee was a Satellite Aerodrome to Point Cook and Laverton air bases. It was designed only for training of air crews and had no formal runways – just grassed landing strips. There were five hangars, a workshop and accommodation and administration buildings. Today only two hangars and the workshop remain.

To accommodate aircraft – such as the B-24 – with large wingspans, hangars had to provide a very wide unobstructed space. At the time, due to war time restrictions, steel was scarce and timber was used for building construction wherever possible. American engineers had designed steel trusses with long spans. The designs were brought to Australia but steel was in short supply and Australian hardwoods were substituted. This material was readily available and much stronger allowing very long spans to be achieved.

The construction of buildings for the military in Australia was often undertaken, as in this case, by the Allied Works Council (AWC) using the Civil Construction Corps (CCC) for actual construction.

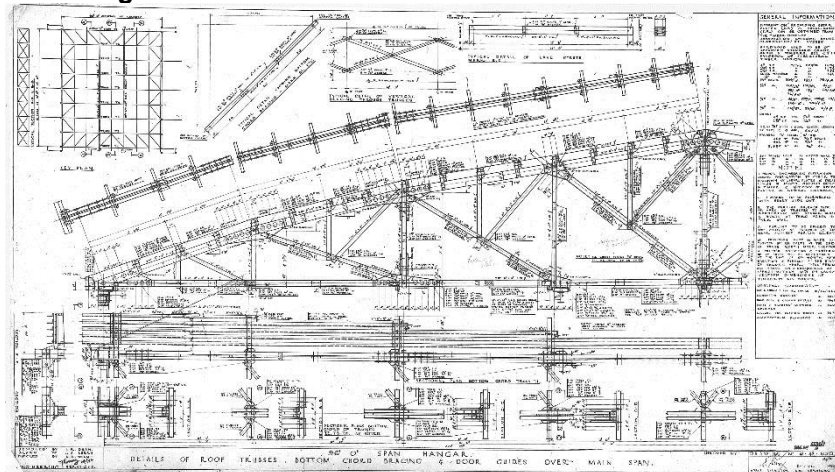


**Werribee Hangar No.1 Source: Owen Peake**

The use of the TECO Shear Plate Connectors in the trusses for the hangars appears to have been a significant innovation in Australia. It may be that these hangars were the first use of these connectors in Australia. The Shear Plate Connectors, originally designed for use with American softwoods avoided damage to the timber in the joint from over-tightening the bolts to achieve greater friction between of components being joined. The Shear Plate Connectors were installed within circular recesses inside the joint and spread the stresses in the joint effectively.



**Roof truss node in Hangar 2. This node contains Shear Plate Connectors. Source: Owen Peake**



**Original Drawings of the hangars have survived. This drawing is typical. Source: B-24 Liberator Memorial Restoration Australia Inc.**

## *Key people associated with the Werribee Hangars*

### **Edward Theodore (1884 – 1950)**

Theodore was elected to the Queensland Parliament and set up the Amalgamated Workers Union in Queensland. He was Premier of Queensland in 1919 then moved to Federal Politics becoming a member of the House of Representatives for a Sydney seat in 1927. He was Federal Treasurer in 1929-30.

Hard-driving Director-General of the Allied Works Council, he recommended the formation of the Civilian Construction Corps (CCC) to increase the construction capacity for military facilities without over-loading the military construction units. The CCC eventually employed over 77000 workers. He helped Australia and the US win the War by providing essential facilities behind the scenes.



**Edward Theodore**  
***Source: State Library of  
Queensland***

**General George Kenney DFC, USAAF (1889 – 1977)**

Kenney had long experience starting in World War I. He became an expert in air operations tactics and his hands-on approach and long experience as a military pilot placed him in a position of considerable respect.

Kenney commanded the US Fifth Air Force, based in Brisbane. This force flying alongside the RAAF operated in the Southwest Pacific Region. Their particular targets were enemy shipping and the increasingly isolated enemy bases throughout “The Islands”.

The mighty Liberator was one of the ‘tools of trade’ of these air forces.

After World War II Kenney became the first commander of the US Air Force Strategic Air Command.



**General George Kenney DFC, USAAF**  
***Source: Life Magazine, 1943***

## *B-24 Liberator Memorial Restoration Australia Inc*

The group was established in 1989 with the objective of obtaining a Liberator and restoring it as a memorial to those who had served in Liberators.

The badly deteriorated fuselage of A72-176 was obtained in 1995. Gradually other parts came to hand as the restoration of the airframe, engines and the many complex systems progressed. The aircraft was dedicated in 2000 and work continues with a large team of volunteers taking part in the work.



**A72-176: the front section of the fuselage soon after acquisition and the dedication of the aircraft in 2000. Source: B-24 Liberator Memorial Restoration Australia Inc.**



**Left: Pratt & Whitney Twin Wasp Engine; Right: before and after views of rear fuselage looking towards the rear gun turret. Source: Left: Owen Peake; Right: B-24 Liberator Memorial Restoration Australia Inc.**



*This document has been prepared as a handout for the ceremony to recognise the B-24 LIBERATOR and the WERRIBEE SATELLITE AERODROME HANGARS under the Engineering Heritage Australia, Heritage Recognition Program.*

*Prepared by Engineering Heritage Victoria.*

*The ceremony was arranged by Engineering Heritage Victoria in association with B-24 Liberator Memorial Restoration Australia Inc.*

**JUNE 2014.**

## Attachment 6 - Media Release

### How time flies – Australia's last B-24 Liberator aircraft and hanger recognised

A double dose of Australian wartime heritage will be recognised next Sunday at the Werribee Satellite Aerodrome, when a restored B-24 Liberator aircraft and the 96 foot span timber hangar which houses it, are awarded Engineers Australia Heritage Markers.

“Both the Liberator, and the Werribee Satellite Aerodrome Hangars are last of their kind in Australia and hold historical significance for Australians. The Liberator aircraft was pivotal in defending Australia against Japanese forces assembled to our north in World War II, and the American-designed hangars represented a solidification of the relationship between newly allied Australian and American forces,” said Engineering Heritage Victoria Chair, Mr Owen Peake.

“The first aircraft to be recognised under the Engineers Australia Heritage Recognition Program, the B-24 Liberator, features the Davis Wing, a breakthrough in aeronautical engineering design at the time. The Davis Wing allowed the B-24 Liberator to carry greater bomb loads, and to fly higher, longer and faster than other bombers of the time.

“This aircraft is the last remaining B-24 aircraft that served in the Royal Australian Air Force during World War II and has been lovingly restored to its former glory by a team of volunteers from B-24 Liberator Memorial Restoration Australia Inc, (many of whom will be present at the recognition ceremony).

“The American designed aerodrome hangars will also be recognised in the ceremony. The design of these hangars was modified by Australian engineers to use plentiful Australian hardwood, allowing the hangars to achieve similar spans to their steel counterparts. The 130 foot hangar is the last of its kind in Victoria, and the 96 foot hangar – which houses the restored B-24 aircraft – is the last of its kind in Australia.”

“Engineers Australia is proud to recognise these two excellent examples of Australian history and engineering ingenuity,” said Mr Peake.

**Ceremony date:** Sunday 13 July 2014

**Time:** 2:00pm to 2:40pm

**Location:** B-24 Liberator Memorial Restoration Australia Inc, Princes Highway and Farm Road, Werribee. The ceremony will be inside the hangar containing the B-24 Liberator.

-ENDS-

Suggested changes by Owen Peake 1 July 2014.

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## **Attachment 7 - EA Magazine Article**

### **Remembering the B-24 Liberator**

In the dark days after the bombing of Pearl Harbour on 7 December 1941 and the entry of the United States into the Pacific War, a powerful alliance was formed between the US and Australia.

The United States moved its huge industrial economy into top gear in order to protect itself. Australia provided the bases and facilities to form a jumping-off point for military action to defend the South West Pacific Region. Australia and the United States fought together until the end of the War and have remained close allies.

As a part of this alliance Australia acquired a fleet of 287 B-24 Liberator heavy bombers for the Royal Australian Air Force (RAAF). These aircraft became the principal heavy bomber of the RAAF until the end of the War.

The B-24 Liberator was designed and by Consolidated Aircraft Corporation of San Diego California. Aircraft production was split between Consolidated and Ford Motor Company which built nearly half the 18,400 Liberators produced.

The Liberator was used by many Allied air forces during World War II. More Liberators were built than any other American military aircraft during World War II. It could carry a heavier weapons load farther and fly faster than comparable heavy bombers.

The Liberator proved to be very effective in the hands of skilled and dedicated crews. RAAF Liberators flew from bases in Northern Australia and the Islands.

The Liberator incorporated a number of design innovations and first flew at the end of 1939. Most importantly it incorporated the Davis Wing design which gave greater lift. The aircraft also incorporated Fowler flaps (which were relatively novel in the late 1930s although most modern airliners incorporate them); it was the first four-engine large aircraft to incorporate a tricycle undercarriage and later Liberators were fitted with airborne search radar which was novel at that time.

The four engines for the Liberator were a high point of aeronautical engineering. The huge 1200 horsepower, 14 cylinder, air cooled Pratt & Whitney Twin Wasp radial engines were a highly complex engine, however they proved to be very reliable. Huge numbers were produced and were used on many aircraft types including the legendary DC3 freighter/airliner and the Consolidated Catalina maritime reconnaissance aircraft, also operated very successfully by the RAAF during World War II.

The only Liberator surviving in Australia has been restored by the B-24 Liberator Memorial Restoration Australia Inc at its base at Werribee, south west of Melbourne. Parts of this aircraft, RAAF serial number A72-176, were acquired in 1995. The aircraft has been under restoration for over twenty years and is now nearing completion.

Engineering Heritage Victoria recognised the Liberator with an Engineering Heritage International Marker on 13 July at a ceremony at Werribee.

The ceremony also recognised the hangars of the Werribee Satellite Aerodrome which incorporate Australian hardwood timber roof trusses of up to 40 metre spans. The Liberator is housed in one of these hangars.

Owen Peake  
Engineering Heritage Victoria

## PHOTOGRAPH CAPTIONS

A RAAF Liberator in flight during World War II. *Image: RAAF*

[Image ID: 065 RAAF A72-116 in flight](#)

Restoration of A72-176 looking from the bomb bay to the back of the cockpit. *Image: Owen Peake*

[Image ID: 007 Restoration A72-176 from bomb bay to cockpit](#)

## **Attachment 8 - EHA Magazine Article**

### **Engineering heritage aspects of the B-24 Liberator**

The Liberator story is a complex one. The aircraft was a key weapon on the Allied side in both the Pacific and European theatres during World War II. The development and manufacture of the aircraft in the United States was both innovative and heroic. In Australian service with the Royal Australian Air Force (RAAF) the aircraft played a key role in fighting back against the Japanese presence in the South West Pacific Region. In more recent years the restoration of the last Australian Liberator, A72-176, has been a great story of dogged determination to get the job done and mateship within the Liberator Community. Each of these aspects is an engineering heritage story in its own right.

#### **Historical Context**

In the dark days after the bombing of Pearl Harbour on 7 December 1941 and the entry of the United States into the Pacific War, a powerful alliance was formed between the US and Australia.

The United States moved its huge industrial economy into top gear in order to protect itself. Australia provided the bases and facilities to form a jumping-off point for military action to defend the South West Pacific Region. Australia and the United States fought together until the end of the War and have remained close allies ever since.

As a part of this alliance Australia acquired a fleet of 287 B-24 Liberator long range heavy bombers for the RAAF. These aircraft became the principal heavy bomber of the RAAF until the end of the War.

#### **Consolidated and the Liberator**

The B-24 Liberator was conceived, designed and built by Consolidated Aircraft Corporation (1923 – 1993) of San Diego, California. The founder of this company, Reuben H Fleet (1887 – 1975) had long experience in aviation and proved to be a great salesman for his products. He also employed the best aeronautical engineers of the time. When the Liberator was ordered in huge numbers Fleet realised that his company facilities in San Diego could not meet the demand. A plant was built by Ford Motor Company at Willow Run in Michigan which built nearly half the 18,400 Liberators produced. Consolidated also built a plant at Fort Worth, Texas to produce Liberators. The Liberator was used by many Allied air forces during World War II.

More Liberators were built than any other American military aircraft during World War II. It could carry a heavier weapons load farther and fly faster than comparable heavy bombers.

## **Liberator in RAAF Service**

The Liberator proved to be very effective in the hands of skilled and dedicated RAAF crews. RAAF Liberators flew from bases in Northern Australia and the Islands. Their principal targets were Japanese airfields, fuel storage facilities and merchant navy shipping. They tore craters in hundreds of runways to make them unusable, bombed fuel supplies and sank freighters supplying forward bases.

## **Liberator Engineering Innovation**

The Liberator incorporated a number of design innovations and first flew at the end of 1939. Most importantly it incorporated the Davis Wing design which gave greater lift. The aircraft also incorporated Fowler flaps (which were relatively novel in the late 1930s although most modern airliners incorporate them); it was the first four-engine large aircraft to incorporate a tricycle undercarriage and later Liberators were fitted with airborne search radar which was novel at that time.

The four engines for the Liberator were a high point of aeronautical engineering. The huge 1200 horsepower, 14 cylinder, air cooled Pratt & Whitney Twin Wasp radial engines were a highly complex engine however they proved to be very reliable. Huge numbers were produced and were used on many aircraft types including the legendary DC3 freighter/airliner and the Consolidated Catalina maritime reconnaissance aircraft, also operated very successfully by the RAAF, during World War II.

## **Last Survivor – A72-176**

The only Liberator surviving in Australia has been restored by the B-24 Liberator Memorial Restoration Australia Inc at its base at Werribee, south west of Melbourne. The derelict fuselage of this aircraft, RAAF serial number A72-176, was acquired in 1995. The wings were salvaged from a crashed Liberator in New Guinea; other parts came from all around the world; engines were acquired from various sources and some parts were re-manufactured from scratch. The aircraft has been under restoration for over twenty years and is now nearing completion. It will not be restored to flight condition but will be complete in every other way including the ability to run all engines.

As mentioned, A72-176 was equipped with an airborne search radar. In very recent times a radar of the correct type has been acquired by the B-24 Group and is currently being restored prior to installation in the aircraft.

## **EHV Role**

The Liberator and the Werribee Satellite Airfield hangars were included in the 2013/2014 Victoria University Work Experience Program. Four engineering students wrote the two nominations over the summer university break.

Engineering Heritage Victoria recognised the Liberator with an Engineering Heritage International Marker and the hangars with an Engineering Heritage Marker on 13 July at a ceremony at Werribee.

Owen Peake  
Engineering Heritage Victoria

## PHOTOGRAPH CAPTIONS

- 1) Liberator production line at Ford Motor Company's Willow Run, Michigan. *Image: United States Air Force [http://ww2db.com/image.php?image\\_id=3376](http://ww2db.com/image.php?image_id=3376)*

Image ID: 026 Willow Run production line

- 2) A RAAF Liberator in flight during World War II. *Image: RAAF*

Image ID: 065 RAAF A72-116 in flight

- 3) A72-176 at Werribee with engine fitted. *Image: B-24 Liberator Memorial Restoration Australia*

Image ID: 023 A72-176 at Werribee

- 4) Restoration of A72-176 looking from the bomb bay to the back of the cockpit.  
Image: Owen Peake

Image ID: 007 Restoration A72-176 from bomb bay to cockpit

## Attachment 9 - Whyndam Leader Article

# Heritage status awarded to Werribee's B24 Liberator and hanger for engineering excellence



Engineering Heritage Australia has accorded heritage status to the B24 Liberator and hanger for engineering excellence to try help prevent demolition. Volunteers Frank Zielinski (left) and Nat Eichler.

## **HISTORY was made in Werribee on the weekend with the B-24 Liberator aircraft and its hangar awarded Engineers Australia Heritage Markers.**

The aircraft is the last of its kind and has been under restoration at the 29m hangar in Werribee by a group of volunteers.

Engineering Heritage Victoria chair Owen Peake said the Liberator and the Werribee Satellite Aerodrome hangars held historical significance for Australians.

"The Liberator aircraft was pivotal in defending Australia against Japanese forces assembled to our north in World War II and the American-designed hangars represented a solidification of the relationship between newly allied Australian and American forces," he said.

Mr Peake said the Liberator, which was the first aircraft to be recognised under the Engineers Australia Heritage Program, featured the Davis Wing, which had been a breakthrough in aeronautical engineering design.

"The Davis Wing allowed the B-24 Liberator to carry greater bomb loads and to fly higher, longer and faster than other bombers of the time."

B24-Liberator Memorial Restoration Fund secretary Judith Gilbert said the award was great news for the group.

**WHYNDAM LEADER Sarah Anderson 19 JULY 2014**

## **Attachment 10 - Body of typical thank you letter**

### **DRAFT 1 (to go on Division President's Letterhead)**

Dear.....

On behalf of Engineers Australia, Victoria Division and Engineering Heritage Victoria, I would like to thank you for your support of and contribution to the B-24 LIBERATOR and WERRIBEE HANGARS Heritage Recognition Ceremony on 13 July 2014.

The event was very successful and the recognition of the site is an important step to inform present and future generations of Australians of two important engineering heritage stories from Australia's World War II history.

Events of this nature are valuable to Engineers Australia to inform and inspire the engineering profession about the importance of the heritage of engineering and are equally important to the local communities in which significant engineering heritage sites are located to inform the public and instil a sense of civic and community pride in the achievements of the community.

Yours sincerely

Geoff Hayes  
FIEAust CPEng EngExec  
Division President  
Engineers Australia  
Victoria Division

20 July 2014

**Report prepared by:**

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**20 March 2015**

**CHANGE CONTROL**

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**Based on Shell Document. Initial drafting.**

Replaced image of panel on p7 with version with EHIM